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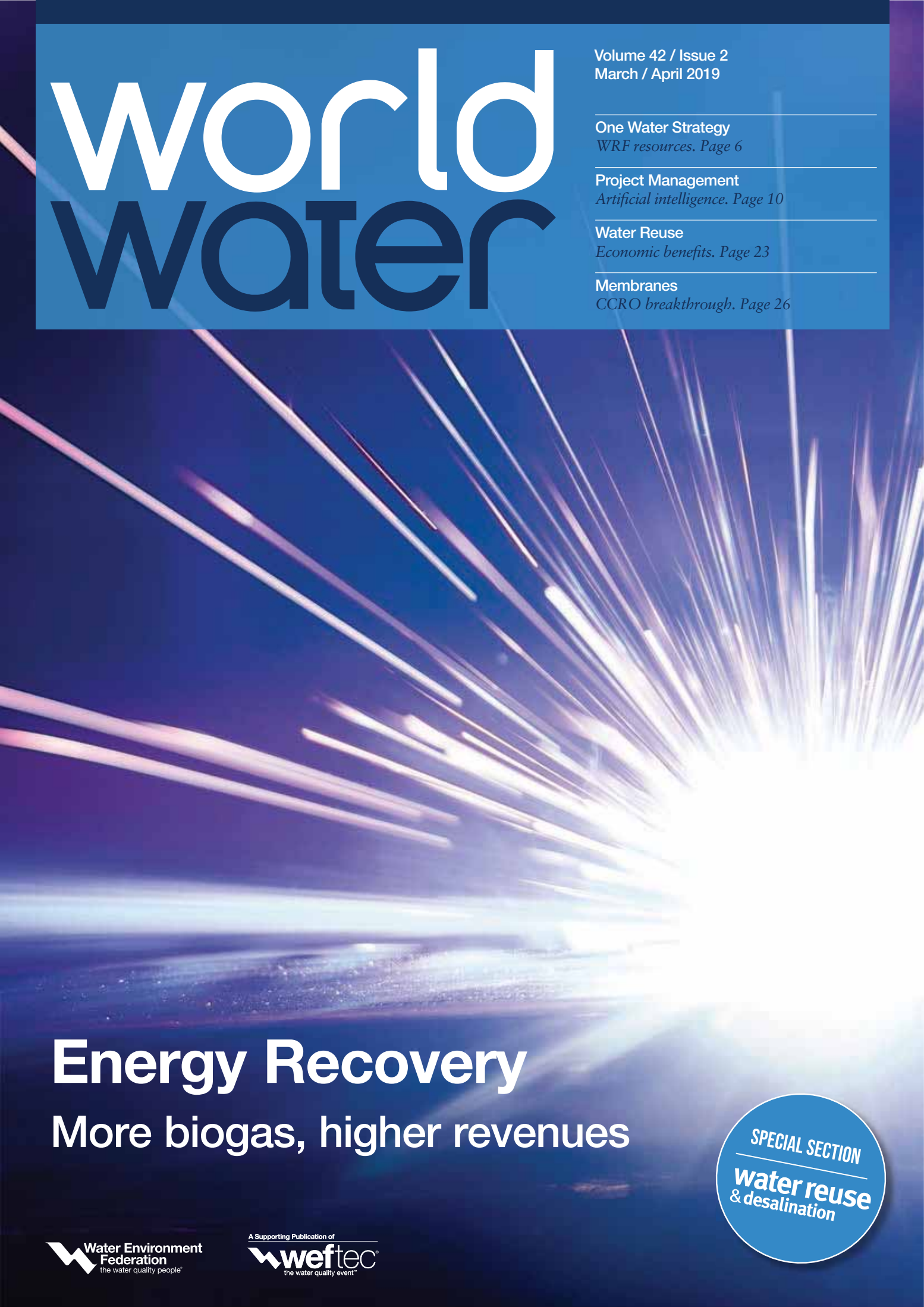

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Myth busting: The value of an interceptor tank in effluent sewer systems

An effluent sewer interceptor tank serves a valuable role in the entire wastewater collection and treatment system. Mike Saunders of Orenco Systems explains how it can generate significant savings by providing low-cost primary treatment.

Interceptor tanks are used in effluent sewer systems to retain a large percentage of solids at the source of the wastewater, with treatment occurring at the individual sites. The treated – and essentially solids-free effluent – is then conveyed for final treatment and disposal. Solids separation is facilitated by an interceptor tank, which is designed and operated similarly to a septic tank. For this reason, effluent sewer systems are also referred to as Septic Tank Effluent Pump (STEP) systems

Unfortunately, sub-standard septic tanks have negatively affected the reputation of STEP systems – and, in turn, have affected the general perception of interceptor tanks. For this reason, it's important to understand the role of the interceptor tank not only as part of the collection portion but also as part of the entire wastewater collection and treatment system.

The good news is that the retention of solids in the interceptor tank generates significant cost savings that are often not quantified or considered when designing an integrated wastewater collection and treatment system.

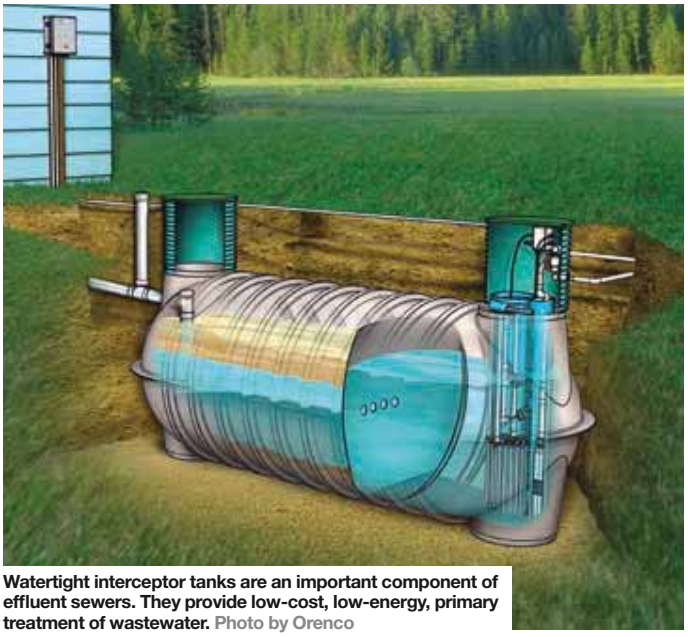
Septic tanks have been in use for more than 150 years. Today, they service more than 21 million homes in the United States (US), or 20 percent of homes in the nation, as part of septic systems, according to the US Environment Protection Agency. Throughout the US, existing septic systems are aging, and a large percentage of these are near or past the end of their useful life. For example, the Florida Department of Health estimates that there are 2.6 million septic systems in the state, of which 2 million are stated to be older than 20 years. While there is no reliable data available, conservative estimates of septic system failures at any given time are in the range of 10-30 percent. As a result, septic tanks have somewhat of a bad reputation.

In order to better understand septic systems and their alternatives, the following is an overview of the differences between a septic tank and an effluent sewer interceptor tank, the important function an interceptor tank performs in an effluent sewer, and how to quantify the value of the interceptor tank through a very simple method.

A typical septic system consists of a septic tank and some type of subsurface treatment and disposal. Most septic systems rely on homeowners for maintenance, with periodic inspection by local health officials. Problems that occur in a septic system can include failure of the subsurface system, piping failures, inadequate sizing, inadequate maintenance, and failure of the septic tank itself. Tank issues include missing baffles or outlet tees, bottomless tanks, collapsed or cracked tanks, and open tanks. Various studies that quantify septic system failures typically show failed tanks as the primary issue in a failed septic system, accounting for around 50 percent of total failures (Day, 2008). Failures in septic tanks are primarily related to poor design, poor construction, poor maintenance, and – most notably – aging beyond their useful life.

An effluent sewer interceptor tank, when properly designed and constructed, is typically larger than a septic tank and is often constructed of fiberglass reinforced polyester (FRP) or high-density polyethylene (HDPE). Strict fabrication, testing, and installation protocols are established and followed to ensure that the tank is watertight and structurally sound. FRP and HDPE products are commonly used in many wastewater collection and treatment technologies due to the long-term, reliable strength and structural integrity they provide. For this reason, just like any wastewater collection system that is properly designed, contracted, and maintained, interceptor tanks used in effluent sewers have little in common with the aging septic tanks often found in failed septic systems.

An interceptor tank, as part of an effluent sewer, provides low-cost, low-energy primary treatment of wastewater. The constituents of full-strength wastewater can be in the range of 450 milligrams per liter (mg/L) 5-day biochemical oxygen demand (BOD_5), 503 mg/L total suspended solids (TSS), and 164 mg/L fats, oils, and grease (FOG). By comparison, typical wastewater exiting an interceptor tank following primary treatment is very low in FOG and is in the range of 140 mg/L BOD_5 and 30 mg/L TSS. Based on these concentrations, a residential connection serviced by effluent sewer will produce



Watertight interceptor tanks are an important component of effluent sewers. They provide low-cost, low-energy, primary treatment of wastewater. Photo by Orenco

A Septic Tank Effluent Pump, or STEP, system should not be perceived negatively based on the reputation of sub-standard septic tanks used in an onsite septic system.

Left: Interceptor tanks are unobtrusive and can easily blend into landscaping, as evident at this residence in Vero Beach, Florida, United States.
Photo by Orenco

approximately 189 fewer pounds of BOD and 286 fewer pounds of TSS annually.

In an effluent sewer, the majority of the solids are broken down and digested as part of primary treatment, while the solids that cannot be broken down anaerobically accumulate in the interceptor tank. According to Orenco Systems, these solids can typically be retained for more than 10 years, depending on the maintenance protocols being used. Conservatively, the annualized cost to manage and dispose of retained solids is approximately US$24 per household, per year.

The 2010 Water Environment Research Foundation (WERF) performance and cost fact sheets for decentralized systems show that the operation and maintenance (O&M) costs for effluent sewer and gravity sewer wastewater collection systems are essentially equal. This cost comparison includes the cost of managing solids from the interceptor tanks of effluent sewer systems. This comparable cost was confirmed in a long-term cost study performed at the City of Lacey, Washington, US. Accordingly, this study assumes that the collection system costs are equal between gravity and effluent sewer, and focuses solely on potential savings generated in the treatment process that can be attributed to a reduction in wastewater strength.

Treatment process savings due to lower-strength wastewater from an effluent sewer include reduced energy demand, reduced chemical use, less biosolids handling, and less biosolids disposal. These combined expenses can make up a substantial portion of the total wastewater treatment cost. Rather than detail the operational savings in various processes, this analysis uses the surcharges implemented by actual utilities for BOD and TSS. These surcharges are typically assessed per pound of treated BOD and TSS to industrial users that produce high-strength waste. In practice, consultants derive these rates by calculating the actual cost that a treatment plant incurs for the treatment of BOD and TSS.

The 2010 National Association of Clean Water Agencies (NACWA) survey of more than 100 municipalities found that the average BOD and TSS surcharges were US$0.3112/lb and $0.2588/lb, respectively. Review of various rate resolutions across the US supports these averages. Based on these costs – and factoring in the reduction in wastewater strength – the upper bounds of potential savings through use of an effluent sewer collection system would be more than $132 per year per residential customer.

The derivation of surcharges for BOD and TSS includes both fixed costs, such as labor, and variable costs, such as electricity and chemicals. Generally, operational savings attributable to BOD and TSS are specific to variable costs. BOD has a major impact on costs associated with activated sludge processes, aeration equipment, clarifiers, and, to a lesser extent, headworks and sludge disposal. TSS has a major impact on costs associated with solids handling, clarifiers, and solids disposal. Actual costs are highly variable, depending on the type of treatment process and operating protocols. Based on review of actual surcharge derivations, variable costs that can be impacted by BOD and TSS range from 15-40 percent of the total surcharge. For a single residential connection, $20-50 annually appears to be a reasonable range of treatment savings that can be anticipated due to the reduced BOD and TSS generated by an effluent sewer collection system.

Additional possible capital savings attributable to lower-strength wastewater – as well as savings related to the associated debt service – can also be realized in investments such as headworks, clarifiers, aeration basins, solids handling infrastructure, and blowers. Surcharges for BOD and TSS do not include these costs.

While this study doesn't develop definitive savings associated with reduced wastewater strength, it does provide a simple method to highlight the potential value that an interceptor tank generates in a complete wastewater collection and treatment process. This value is often not quantified in a comparative analysis of wastewater collection systems; however, it should be. The value of the tank relative to offsetting cost savings in the collection system and treatment process is highly variable – but still measurable. A watertight, high-quality interceptor tank, while similar in concept to a septic tank, is not merely a septic tank. It's a valuable component of a wastewater collection and treatment process, generating significant offsetting savings through the low-cost primary treatment that occurs within the tank.

A Septic Tank Effluent Pump, or STEP, system should not be perceived negatively based on the reputation of sub-standard septic tanks used in an onsite septic system. When planning and selecting collection and treatment options, the value of the interceptor tank should be fully understood and measured as part of the decision-making matrix of the entire system – not only the collection portion.

Author's Note

Mike Saunders is the market segment leader for engineered systems at Orenco Systems, Inc., based in Punta Gorda, Florida, United States. Saunders has a bachelor's degree in civil engineering and has worked in municipal wastewater treatment and collection for more than 25 years.

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Other references used in the development of this article are available from the author.